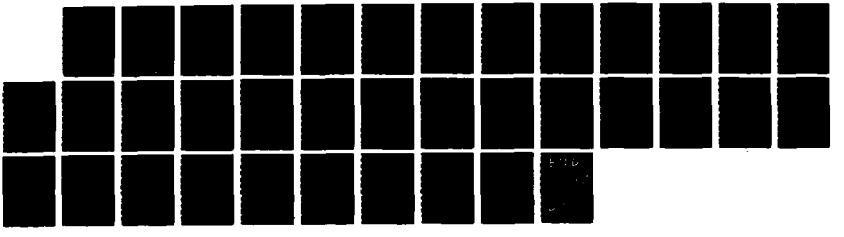
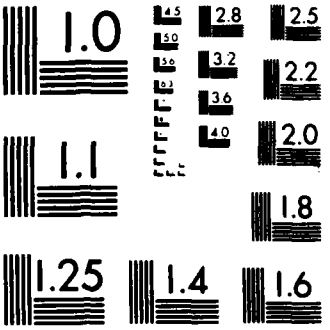
AD-A184 017 COMPETITION ANALYSIS MODEL (CAM) VOLUME 2 COMPUTER MANUAL(U) ADMINISTRATIVE SCIENCES CORP ARLINGTON VA 12 JUN 87 ASC-R-162 BRMC-85-5129-2 F33615-85-C-5129 1/1

UNCLASSIFIED F/G 12/5 NL





BRMC-85-5129-2
ASC-R-162
June 12, 1987

COMPETITION ANALYSIS MODEL
******CAM******

Computer Manual
Volume II

Contract No. F33615-85-C-5129

Prepared for:

Air Force Business Research Management Center

United States Air Force
Wright-Patterson AFB, Ohio 45433-6583

Prepared by:

Administrative Sciences Corporation
5305 Lee Highway
Arlington, Virginia 22207
(703) 534-1133

COMPETITION ANALYSIS MODEL
Computer Manual

Volume II

Table of Contents

A-1

CHAPTER I

INTRODUCTION

CAM software is a PC base package for use in analyzing the cost impact of competition. This volume, the **Computer Manual**, is directed at the user who wishes to run the software and understand how the software can be used to do cost analysis of competition. The user who wants to understand the rationale for the inputs required by CAM and the computations it performs should consult **Volume I**. Volumes I and II together constitute the complete Competition Strategy Decision Support Model.

CAM has been developed to run on IBM PCs and PC compatibles. It is designed to be used without the need for continued reference to a manual by appropriate use of help menus and program prompts. The program prompts indicate to users what needs to be done at each step. There is also a help facility. Help can be turned on or off by pressing (H)elp–turn ON or (H)elp–turn OFF when the menu currently on display has this option. The help facility takes the form of more detailed text within the menus. (Help does not take the form of a separate help menu). By embedding the help messages into the menus, CAM puts the information where it is most useful for the user. The help menus briefly explain each of the requested inputs and are designed for users familiar with the basic concepts of doing a cost analysis of competition. If more explanation is required, users should consult **Volume I** where detailed explanations of all aspects of creating a competition strategy including the computational procedures and input requirements are discussed. Chapter VI of Volume I – Cost Benefit Analysis – is the primary chapter of relevance for information on the computational details of CAM.

This manual first focuses on helping new CAM users get started. These introductory sections are contained in Chapters II and III. The later sections discuss how various analyses are performed and how CAM does these analyses. There are sections describing how CAM calculates competitive savings, how to use and understand shifts and rotations, and information on data files. A glossary of terms has been provided in the last pages of the manual to provide the user with a quick reference to CAM options and features. This manual has been designed to be used as a reference guidebook to the CAM software. The new user should become familiar with the contents and organization of the manual as this will help to acquaint him with CAM functions and capabilites.

CHAPTER II

BEFORE GETTING STARTED

CAM is designed to run on IBM PC and PC compatible personal computers with DOS version 2.0 or higher. CAM requires only 64K of RAM. It does not require an 8087 Math coprocessor chip or graphics board. Use of a 132 column printer would simplify printing tables but is not required.

CAM software is contained in the disk supplied with this manual. CAM is programmed in BASIC and has three parts: CAM, CAM2 and CAM3. The disk contains eight files, six are for CAM in both the source code version (identified as CAM.BAS, CAM2.BAS and CAM3.BAS) and the compiled version (identified as CAM.EXE, CAM2.EXE, and CAM3.EXE). The disk also contains BASRUN.EXE, a program necessary to run compiled versions of BASIC. The eighth file is a sample data file (Sample.CAM) designed to show a new user what his data requirements are.

CAM can be run in either the source code or compiled version. To run in the compiled version requires merely that at the "A" prompt, the user types CAM and presses return. In a double disk drive system, in addition, the CAM disk can be inserted in the B drive. This requires that at the "A" prompt the user types B:. At the "B" prompt type CAM followed by pressing return. Most users would use the compiled versions because it runs faster.

Even though CAM runs more slowly through BASIC it may be desirable to do so to enable the user to change print fonts and/or formats or list the program. When running CAM through BASIC the user can use either Procedure I or Procedure II.

Procedure I

First load BASIC and then replace the BASIC disk in drive A with the CAM disk and load CAM. For example:

A>**BASICA** (press return)

when Basic has been loaded you will see:

OK

put CAM disk in the A drive

then press F3, LOAD" will appear then type

LOAD"**a:CAM** (press return)

OK

then press F2 to have CAM run

RUN

Procedure II

A> **B:** (press return) The default drive is now "B"

B> **a:basica cam** (press return) "B" remains the default drive

the following message will appear,

```
Type in path name containing BASICA. EXE
and (Y/N) to indicate if any disk needs
to be replaced
***Do not replace yet***
Format:  path name (,Y or N)

then type,

a:  (press return)
```

You are now running CAM through BASIC. To return to the system from the main menu type (Q)uit.

Data entry must conform to the following conventions. All dollars are in millions. Thus a first unit cost of $250,000 should be entered as .25. Percentages should be entered as whole numbers. Thus a learning curve slope of 90% should be entered as 90, not .90. Quantities are also in whole numbers. A buy of 1,000 units should be entered as 1000. Fiscal years should be entered using just the last two digits; FY1981 is entered as 81.

Before the user can become familiar with the CAM options he must know how to move about within the program. This may at times be frustrating as the user cannot return directly to the main menu from all areas of the program. He may have to answer the prompts by inputting information so that he may return to the main menu. If the user does not have the correct information he may enter "dummy" values and later change them through use of the (C)hange data function. Chapter IV of this volume demonstrates how the (C)hange data function operates.

CHAPTER III

GETTING STARTED

Chapter III is designed to guide the new user through his first attempt at using CAM. Explanations and sample screens are used to instruct the new user on how to access CAM, how to use CAM data files and create new ones. Included in the section on creating new data files are discussions on how data can be entered, the nature of the data entered, understanding and entering the shift/rotation data and how to view and edit files.

At the "A" prompt (A>), type CAM and return. (The experienced user may wish to bypass the introductory screens and go directly to the main menu. To do so the user should enter CAM2 rather than CAM at the "A" prompt.) After typing CAM, the title screen will come up, as seen in Figure III-1a.

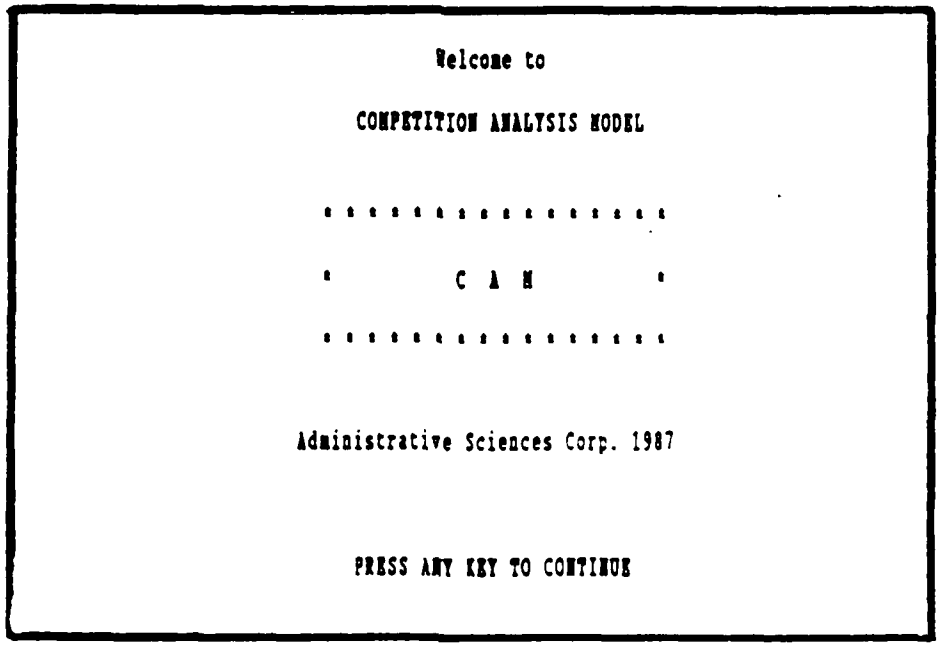


FIGURE III-1a

Pressing return three times will bring up the sequence of introductory text seen in Figures III-1b, III-1c and III-1d. The question as whether the printer is set for 132 columns, (Figure III-1c), allows users with 132 column printers to get more information printed out in one table. All information is available, but 80 column printing requires printing more separate tables via the help menu. Figure III-1d shows the basic options that CAM allows the user.

```
                              PURPOSE

     CAM, the Competition Analysis Model, helps you do a cost analysis
     of production competition. It will be valuable only if you take
     care to assemble realistic assumptions. CAM has the ability to
     simplify sensitivity analyses, and it can perform various
     breakeven analyses where second source parameter values are
     determined that equate costs under Sole Source and Competition.

                            METHODOLOGY

         The model calculates competitive savings by comparing estimated
     SOLE SOURCE costs with estimated COMPETITIVE costs. To use the
     model, establish a set of base case parameters based on sole source
     assumptions. Then, enter data for the same case using parameters
     expected in a competitive environment. After performing this
     base case analysis, sensitivity analysis can be conducted on
     each parameter.

         The model will prompt each response. Detailed instructions are
     found in the accompanying user's manual.

PRESS ANY KEY TO CONTINUE
```

FIGURE III-1b

```
Is your printer set for 132 columns (or more)? If not and you want wide
screen, hit Control Break and set printer before running the program.

ENTER THE APPROPRIATE LETTER (Y)es or (N)o?
```

FIGURE III-1c

```
CAM allows you to do the following:
  (1) Input, change, or display data
  (2) Analyze competition when the factors are known
  (3) Perform breakeven analysis when all factors are known except one

PRESS ANY KEY TO CONTINUE
```

FIGURE III-1d

Pressing return then causes the following screen to appear which describes the data inputs CAM requires:

```
The program is designed to accept data input from the terminal or from data
files on diskette. Terminal input accepts data in the following order:
   # of years during which costs will be incurred
   First year (a two digit code such as 87)
   Discount rate at which future costs are converted to present value
   Sole Source, 1st Competitive Source, 2nd Competitive Source
     Non-Recurring Costs by Year, Quantity By Year, 1st Unit Cost,
     Progress (Learning) & Production (Lot Size) Rate Parameters
   Timing of Shift/Rotation in Progress Rate Parameter (specified by year
     or unit # of sole source production schedule). A shift to a lower/more
     efficient progress curve and/or steeper progress curve can be entered
     for the 1st or 2nd competitive source or both. The user may specify up
     to 5 different times for shift/rotation, or none.

You will be given menu prompts. When you make a selection you will move to
a lower menu for more specific prompts. You can move back up the menu
hierarchy by typing 'M' for menu up.

There is a HELP facility which is currently on. By typing 'H' at the prompt
you can toggle this capability from ON to OFF and from OFF to ON.

PRESS ANY KEY TO CONTINUE
```

Pressing return brings up the main menu with six options and in addition displays the existing data files:

```
 OLD DATA FILES
SAMPLE  .CAM
 (O)ld data file from disk
 (N)ew data file with data to be entered from the terminal
 (D)elete old data file from disk
 (F)easibility analysis of price reduction
 (H)elp - turn OFF
 (Q)uit program and return to operating system
 ENTER THE APPROPRIATE LETTER?
```

The first two options direct CAM to either (1) select one of the existing data files, listed at the top of the screen, for review or analysis, or (2) to create a new file. Naturally a new user will have no existing data files. However, the new user has the Sample data file to demonstrate CAM. (H)elp - turn off is the help option. Most users will find it helpful to keep the help menus on for the first few times through the program. If a user desires to turn the help screen off, he should do so before selecting the (O)ld or (N)ew options. (D)elete erases old files from the disk. (Q)uit terminates CAM execution and returns to DOS. For a detailed discussion of feasibility analysis option please see Chapter IV of this manual.

Existing Data Files

When O is selected, followed by return, CAM asks for the name of the file. The user needs to enter the exact names of the desired file, otherwise an error message will result. If the help menu is off the following screen will appear (notice the options menu at the bottom of the screen);

```
                        DATA SUMMARY

                    ***** QUANTITIES *****     * NON-RECURRING COST *
FY                  SOLE      1ST C     2ND C      SOLE      1ST C     2ND C

85                 2,300     2,300         0       3.0       3.0      91.0
86                 3,000     3,000         0       2.0       2.0       2.0
87                 4,000     4,000         0       1.0       1.0       2.0
88                 4,000     3,996         4       0.0       0.0       2.0
89                 4,100     2,500     1,600       0.0       0.0       2.0
90                 6,000     3,600     2,400       0.0       0.0       2.0
91                 6,000     3,600     2,400       0.0       0.0       2.0
TOTAL             29,400    22,996     6,404       6.0       6.0     103.0


FIRST UNIT COST    0.779     0.779     0.779     DISCOUNT RATE (%)= 0
PROGRESS CURVE     91.00     91.00     89.00     ASSIGN COMPETITIVE SPLIT
PRODUCTION RATE   100.00    100.00    100.00       TO MINIMIZE COST? NO
SHIFT %                       0.00      0.00     YEAR OF SHIFT/ROT= 89
ROTATION %                    3.00      3.00

(A)nalysis, (B)reakeven, (C)hange data, (D)isplay data, (P)rint
(S)ave data, (H)elp - turn ON, (M)enu up - be sure to save new data first
ENTER THE APPROPRIATE LETTER?
```

If the help menu is on there is not enough room on the screen to print both the data summary and the longer version of the help menu and therefore each is printed on a separate screen, as in Figure III-2.

```
                        DATA SUMMARY

                    ***** QUANTITIES *****    * NON-RECURRING COST *
      FY      SOLE      1ST C      2ND C      SOLE      1ST C      2ND C

      85     2.300      2.300          0       3.0        3.0       91.0
      86     3.000      3.000          0       2.0        2.0        2.0
      87     4.000      4.000          0       1.0        1.0        2.0
      88     4.000      3.996          4       0.0        0.0        2.0
      89     4.100      2.500      1.600       0.0        0.0        2.0
      90     6.000      3.600      2.400       0.0        0.0        2.0
      91     6.000      3.600      2.400       0.0        0.0        2.0
   TOTAL    29.400     22.996      6.404       6.0        6.0      103.0


FIRST UNIT COST    0.779      0.779      0.779     DISCOUNT RATE (%)= 0
PROGRESS CURVE     91.00      91.00      89.00     ASSIGN COMPETITIVE SPLIT
PRODUCTION RATE   100.00     100.00     100.00       TO MINIMIZE COST? NO
SHIFT %                        0.00       0.00     YEAR OF SHIFT/ROT= 89
ROTATION %                     3.00       3.00

PRESS ANY KEY TO CONTINUE



(A)nalysis - Calculate all costs over the program life
(B)reakeven - Find second source parameter values that lead to same costs
   with or without competition
(C)hange data - Any input factors may be altered
(D)isplay input data on screen only
(P)rint input data and analysis on printer and screen
(S)ave data on disk
(H)elp - turn OFF
(M)enu change to higher level - be sure to save new data first
ENTER THE APPROPRIATE LETTER?
```

FIGURE III-2

These results can then either be printed out, saved to disk or subjected to further analysis. Further analysis can consist of either changes to the basic input data, by choosing (C)hange data, or having CAM compute certain boundary conditions by choosing (B)reakeven analysis or calculating likely price reductions using (F)easibility analysis. Chapter IV discusses these options.

New Data Files

If a new data base is to be created then the user selects (N)ew. The new file option requires the user to enter in a straight forward fashion all the data needed to do a basic analysis of the savings from competition. This procedure does require the user in advance of entering data to estimate the split between the two competitors and to estimate the shift and rotation that competition will effect. Users who wish to avoid estimating shift and rotation should read the breakeven analysis section in Chapter IV. Appropriate estimates of non-recurring costs must include the magnitude of the costs, their timing and which competitor incurs these costs. Figure III-3 shows the beginning of the data input sequence for a new case.

```
ENTER each input value at the prompt. If you make an incorrect entry followed
by (cr), it can be corrected at the end of data entry using CHANGE DATA.

# OF YEARS                          ? 3
FIRST FISCAL YR (e.g. 91)           ? 90
DISCOUNT RATE (% or (cr) if 0)      ? 10

********** DATA INPUT FOR SOLE SOURCE PRODUCER **********

INPUT NON-RECURRING COSTS (Millions of $)

Do you want non-recurring costs (Y/N)? y

  90  COST ($M)          =          ? 5
  91  COST ($M)          =          ? 3
  92  COST ($M)          =          ? 0

********** QUANTITIES FOR SOLE SOURCE PRODUCER **********

  90  QUANTITY =                    = ? 100
  91  QUANTITY =                    = ? 300
  92  QUANTITY =                    = ?
```

FIGURE III-3

Data is requested first for the sole source case and then for the competitive case. In the data input sequence for the competitive case, the first question is the split of the production quantity under competition. The options here include a percentage split, where the percentage can be different each year, or direct user input of the annual quantity for each producer. CAM then asks for inputs for first unit cost,

progress (learning) curve slope, and production rate parameter. While requesting values for these parameters for the first source and second source, CAM displays the sole source value for that respective item and gives the user the option of using that value merely by pressing return. For many preliminary analyses, it is useful to use sole source values as the baseline value for both competitors.

Shift and Rotation

Next CAM asks for the input data required for shift and rotation analyses. Competitive cost savings can cause the learning curve to shift, rotate or shift and rotate. A shift occurs as a result of competitive reductions in cost and/or price and rotations are caused by improvements in the learning rate due to the introduction of competition. A rotation causes the slope of the learning curve (progress curve) to change. CAM is very sensitive to rotations and therefore, subtle rotations will produce large changes in prospective cost savings. When competition exists several shifts may occur within the course of one running of the program on a data set. The model can accomodate up to five rotations and five shifts per data set.

Entering shift and rotation data can be confusing if the user is unfamiliar with shift and rotation procedures. Before attempting to input shift/rotation information for a new data file, the user must have the following information:

i) the number of shifts/rotations which occur

ii) how shifts/rotations will be represented - by unit number or year

iii) the year or unit number at which each shift/rotation occurs

iv) the percentage downward shift of the first and second sources under competition for each shift/rotation

v) the percentage rotation of the first and second sources under competition for each shift/rotation

When creating a new data file, CAM will prompt the user to enter this data for each competitor for each shift and rotation. Users who do not want to estimate shift and rotation can do so by entering 0. CAM will then compute the percentage savings required to breakeven using competition.

(C)hanging data for shift and rotation also needs some explanation. The user can elect to change either shift or rotation. After selecting one CAM first asks which one of the S&R you want to change. Even if there is only one, it still asks you the same question. CAM repeats the question if an incorrect number is entered. In Figure III-4, 2 was entered when there was only 1 shift and/or rotation.

```
(A)nalysis, (B)reakeven, (C)hange data, (D)isplay data, (P)rint
(S)ave data, (H)elp - turn ON, (M)enu up - be sure to save new data first
ENTER THE APPROPRIATE LETTER? c

(A)first unit cost, (B)progress curve rate, (C)production rate param -
(D)iscount Rate (%), (L)east cost, (N)on-recur Costs, (Q)uantity, (Y)ears #
(R)otation %, (S)hift %, (T)ime r/s, (#) of r/s, (H)elp - turn ON, (M)enu up
ENTER THE APPROPRIATE LETTER? s


Enter # S/R to change ( there are now 1 ) or (M)enu up? 2

Enter # S/R to change ( there are now 1 ) or (M)enu up? 1

(1)st Competitive, (2)nd Competitive, (M)enu up
ENTER THE APPROPRIATE LETTER OR NUMBER?
```

FIGURE III-4

Chapter IV

UNDERSTANDING CAM OPTIONS

The following chapter has been designed to be used as a reference guide for both the experienced and new CAM user. Explanations and examples are provided for the following CAM options: (A)nalysis, (B)reakeven analysis, (C)hange data, (D)isplay data, (F)easibility analysis, (H)elp, (P)rint and (S)ave. The data file "Sample" supplied on the CAM disk was used to create all of the examples. The new user who wishes to use the options described here, using new data, should first refer to Chapter III as it describes how to create a new data file.

Analysis

The competition analysis output of CAM (Figure IV-1 below) displays information on quantities and recurring and non-recurring costs for sole source and competition. It also displays competitive savings, discounted competitive savings and the discounted competitive gains/losses as a percentage of the sole source cost.

COMPETITION ANALYSIS

	*** SOLE SOURCE ***			******* COMPETITIVE *******					DISCOUNT
		RECUR	N.REC	QUANTITIES *		RECUR	N.REC	COMPET	COMPET
FY	QTY	COST	COST	1ST	2ND	COST	COST	SAVING	SAVING
85	2,300	723.0	3.0	2,300	0	723.0	94.0	-91.0	-91.0
86	3,000	764.6	2.0	3,000	0	764.6	4.0	-2.0	-2.0
87	4,000	930.7	1.0	4,000	0	930.7	3.0	-2.0	-2.0
88	4,000	876.0	0.0	3,996	4	877.8	2.0	-3.9	-3.9
89	4,100	860.9	0.0	2,500	1,600	875.6	2.0	-16.7	-16.7
90	6,000	1,212.1	0.0	3,600	2,400	1,105.0	2.0	105.2	105.2
91	6,000	1,170.1	0.0	3,600	2,400	1,033.0	2.0	135.1	135.1
TOT	29,400	6,537.4	6.0	22,996	6,404	6,309.7	109.0	124.7	124.7

Competitive Saving as % of Sole Source (Discounted) = 1.9

FIGURE IV-1

In Figure IV-1 the help option is off and the printer is set at 80 columns. If the printer had been set at 132 columns the printout would appear as in Figure IV-2. To print the 132 column analysis table turn help off and select the (P)rint option. A data summary table will automatically appear and in the bottom left corner you will see a message asking you to provide a title for the analysis table. Enter the title and press return.

NOTE: The competition analysis that appears on the screen is not the one that will be printed, you should expect to see a table similar to Figure IV-2.

COMPETITION ANALYSIS

	******** SOLE SOURCE *******				COMPETITIVE QUANTITIES		***1ST COMPETITIVE***			***2ND COMPETITIVE***			DISCOUNT	
FY	QTY	RECUR COST	N.REC COST	TOTAL COST	1ST	2ND	RECUR COST	N.REC COST	TOTAL COST	RECUR COST	N.REC COST	TOTAL COST	COMPET SAVING	COMPET SAVING
85	2.300	723.0	3.0	726.0	2.300	0	723.0	3.0	726.0	0.0	91.0	91.0	-91.0	-91.0
86	3.000	764.6	2.0	766.6	3.000	0	764.6	2.0	766.6	0.0	2.0	2.0	-2.0	-2.0
87	4.000	930.7	1.0	931.7	4.000	0	930.7	1.0	931.7	0.0	2.0	2.0	-2.0	-2.0
88	4.000	876.0	0.0	876.0	3.996	4	875.1	0.0	875.1	2.?	2.0	4.?	-3.9	-3.9
89	4.100	860.9	0.0	860.9	2.500	1.600	526.6	0.0	526.6	349.0	2.0	351.0	-16.7	-16.7
90	6.000	1,212.1	0.0	1,212.1	3.600	2.400	732.8	0.0	732.8	372.1	2.0	374.1	105.2	105.2
91	6.000	1,170.1	0.0	1,170.1	3.600	2.400	708.6	0.0	708.6	324.4	2.0	326.4	135.1	135.1
TOT	29.400	6,537.4	6.0	6,543.4	22.996	6.404	5,261.5	6.0	5,267.5	1,048.3	103.0	1,151.3	124.7	124.7

Competitive Saving as % of Sole Source (Discounted) = 1.9

FIGURE IV-2

More information is provided in the 132 column printout as data on competitive production is broken down for first and second competitive producers rather than being summarized under the heading "Competitive". The only way to obtain this information with an 80 column printer is to turn help on and view each calculation separately as in Figure IV-3.

```
The help option shows the detail for the calculation of recurring cost.
This is done for the sole source by year, followed by the 1st
and then 2nd sources under competition, each by year.

                          B+1         B+1  C
COST = [A/(B+1)] [(Q1+.5)   - (Q0+.5)   ]Q  =  723.043
A    = FIRST UNIT COST                  =    0.779       SOLE SOURCE 85
B+1  = LOG(.01*PROGRESS RATE)/LOG(2)+1  =  0.86394
C    = LOG(.01*PRODUCTION RATE)/LOG(2)  =  0.00000
Q    = LOT SIZE                         =    2,300
Q0   = PREVIOUS PRODUCTION              =        0
Q1   = Q0 + Q                           =    2,300

ENTER (Help OFF, Shift PrtScr to Print, or RETURN TO CONTINUE?
```

FIGURE IV-3

When help is on, the details of each recurring cost calculation is shown, when help is off a summary table of these individuals calculations is provided. The help option is useful when the user is becoming familiar with CAM or when he would like to check formulas or specific values in the formulas. Usually, the help menu is off when using the competition analysis option as it enables the user to view all of the final results on one screen in less time.

Breakeven Analysis

When the breakeven option from the main menu is selected the screen which will appear is shown in Figure IV-4.

```
(A) First Unit Cost Solution - The computer solves for the cost of the first
    unit produced by the 2nd Competitive Source that would result in the same
    total cost with or without competition. It is assumed that all other 2nd
    Source values are known.

(B) Progress Curve Solution - The computer solves for the progress rate
    of the 2nd Competitive Source that would result in the same total cost
    with or without competition. It is assumed that all other 2nd Source
    values are known.

(Q) Quantity Solution - The computer solves for the reduced program
    quantity at which the costs are equal under Sole Source and Competition.
    This option is available only if the base case has competitive savings.

(M)enu end and move to higher level menu
ENTER THE APPROPRIATE LETTER? a

Breakeven calculations in progress - Please be patient
```

FIGURE IV-4

Option "A", The First Unit Cost Solution, is used to compute what the first unit cost of the second source would have to be so that the total costs of production are the same between the sole source and competitive case. This analysis option assumes that all other second source values are known, including the learning curve slope and any shift and rotation.

This analysis is useful as it provides the analyst with the maximum cost per unit necessary to breakeven when producing competitively, given the learning curve. Figure IV-5 illustrates what the screen will look like. We can see from this diagram that breakeven occurs with a first unit cost for the second source of $872,000.

Breakeven 1st Unit Cost for Second Source ($M) 0.872 Was 0.779

COMPETITION ANALYSIS

	*** SOLE SOURCE ***			******* COMPETITIVE *******				DISCOUNT	
		RECUR	N.REC	QUANTITIES *		RECUR	N.REC	COMPET	COMPET
FY	QTY	COST	COST	1ST	2ND	COST	COST	SAVING	SAVING
85	2,300	723.0	3.0	2,300	0	723.0	94.0	-91.0	-91.0
86	3,000	764.6	2.0	3,000	0	764.6	4.0	-2.0	-2.0
87	4,000	930.7	1.0	4,000	0	930.7	3.0	-2.0	-2.0
88	4,000	876.0	0.0	3,996	4	878.2	2.0	-4.2	-4.2
89	4,100	860.9	0.0	2,500	1,600	917.1	2.0	-58.2	-58.2
90	6,000	1,212.1	0.0	3,600	2,400	1,149.2	2.0	60.9	60.9
91	6,000	1,170.1	0.0	3,600	2,400	1,071.6	2.0	96.5	96.5
TOT	29,400	6,537.4	6.0	22,996	6,404	6,434.4	109.0	-0.0	0.0

ENTER Shift PrtScr to Print, or RETURN TO CONTINUE?

FIGURE IV-5

NOTE: In all breakeven options, a hard copy of each screen can be obtained by the pressing the shift and print screen keys.

Option "B", **Progress Curve Solution**, computes what the required value of the progress curve for the second source must be to have the total costs of competition be the same as sole source costs, given the baseline inputs for first unit costs and any shift and rotation. This option provides the user with a minimum value (floor) of the progress curve slope of the second source. Should the second source producer's slope be flatter than the breakeven slope there will be no (discounted) savings from competition. In Figure IV-6, the second source producer must have a progress curve with a slope of less than 89.93 to produce competitive savings.

Breakeven Slope for Second Source 89.93 Originally 89.00

COMPETITION ANALYSIS

	*** SOLE SOURCE ***			******* COMPETITIVE *******					DISCOUNT
		RECUR	N.REC	QUANTITIES *		RECUR	N.REC	COMPET	COMPET
FY	QTY	COST	COST	1ST	2ND	COST	COST	SAVING	SAVING
85	2,300	723.0	3.0	2,300	0	723.0	94.0	-91.0	-91.0
86	3,000	764.6	2.0	3,000	0	764.6	4.0	-2.0	-2.0
87	4,000	930.7	1.0	4,000	0	930.7	3.0	-2.0	-2.0
88	4,000	876.0	0.0	3,996	4	877.9	2.0	-3.9	-3.9
89	4,100	860.9	0.0	2,500	1,600	909.4	2.0	-50.5	-50.5
90	6,000	1,212.1	0.0	3,600	2,400	1,151.6	2.0	58.6	58.6
91	6,000	1,170.1	0.0	3,600	2,400	1,077.2	2.0	90.9	90.9
TOT	29,400	6,537.4	6.0	22,996	6,404	6,434.4	109.0	0.0	0.0

ENTER Shift PrtScr to Print, or RETURN TO CONTINUE?

FIGURE IV-6

Option "Q", **Quantity Solution**, solves for the **minimum quantity** that must be produced to breakeven when using competition. The program divides this quantity between two competitive firms automatically and uses cost minimization as its allocative criterion. If the initial inputs yields no cost savings from competition the analysis will not be performed and the following message will appear on the screen:

(M)enu end and move to higher level menu
ENTER THE APPROPRIATE LETTER? q

Breakeven calculations in progress - Please be patient

Quantity Breakeven not allowed as Competition leads to Losses

PRESS ANY KEY TO CONTINUE

When competition leads to savings the screen would look like the screen illustrated in Figure IV-7.

Reduced Quantity for Breakeven 23,981 Originally 29,400

COMPETITION ANALYSIS

	*** SOLE SOURCE ***			******* COMPETITIVE *******				DISCOUNT	
		RECUR	N.REC	QUANTITIES *		RECUR	N.REC	COMPET	COMPET
FY	QTY	COST	COST	1ST	2ND	COST	COST	SAVING	SAVING
85	2,300	723.0	3.0	2,300	0	723.0	94.0	-91.0	-91.0
86	3,000	764.6	2.0	3,000	0	764.6	4.0	-2.0	-2.0
87	4,000	930.7	1.0	4,000	0	930.7	3.0	-2.0	-2.0
88	4,000	876.0	0.0	3,996	4	877.8	2.0	-3.9	-3.9
89	4,100	860.9	0.0	2,500	1,600	875.6	2.0	-16.7	-16.7
90	6,000	1,212.1	0.0	3,600	2,400	1,105.0	2.0	105.2	105.2
91	581	114.9	0.0	349	232	102.6	2.0	10.4	10.4
TOT	23,981	5,482.2	6.0	19,745	4,236	5,379.3	109.0	-0.0	0.0

ENTER Shift PrtScr to Print, or RETURN TO CONTINUE?

FIGURE IV-7

Both the original quantity and breakeven quantity are provided. Should the quantity produced fall below 23,981, the gains from competition would be forfeited.

Change Data

When the user wishes to edit existing data files he should select the change data function from the options menu. This option allows him to alter values in the data file he is currently working in.

When help is on, a detailed description of the changes allowed is provided, as in Figure IV-8 below.

```
CHANGES ALLOWED
(A)first unit cost in $M
(B)progress curve rate - e.g. 90% means that the unit cost of the 2Mth unit
   will drop to 90% of the cost for the Mth unit
(C)production rate parameter - e.g. 90% means that if the lot size in a year
    doubles, the cost of the 2Mth unit drops to 90% of the Mth unit cost
(D)iscount Rate (%) - Costs N years in the future are divided by
   (1+r) raised to the Nth power to reflect their present value
(L)east cost by assigning larger quantities to lowest cost producer.
(N)on-recurring Costs
(Q)uantity of production by year for either source
(Y)ears # in production schedule
(R)otation % for progress curve at time of rotation/shift
(S)hift % for progress curve at time of rotation/shift
(T)ime of rotation/shift - either year or unit #
(#) of rotation/shifts (maximum 5) or change type (year/unit)
(H)elp - turn OFF
(M)enu change to higher level
ENTER THE APPROPRIATE LETTER? h
```

FIGURE IV-8

When the help menu is off the screen appears as:

```
(A)first unit cost, (B)progress curve rate, (C)production rate param
(D)iscount Rate (%), (L)east cost, (N)on-recur Costs, (Q)uantity, (Y)ears #
(R)otation %, (S)hift %, (T)ime r/s, (#) of r/s, (H)elp - turn ON, (M)enu up
ENTER THE APPROPRIATE LETTER?
```

Because the help on screen provides a detailed description of each of the change data options there is no need for further explanation. If the user is using the change data option to compute and compare the effects of varying data values on

the amount of cost savings, he may wish to print each screen of results. By pressing shift and then print screen the user will have a hard copy for use in a comparative analysis.

Display Data

Data summary allows the user to view the information from the file he has called up or from the file he has just created. As illustrated in Figure IV-9 above, the user can see what the discount rate being used is, he can see if he has chosen to assign a competitive split to minimize costs, the year of the first shift/rotation, etc.

NOTE: The user cannot use the cursor to change data values while in the display data option, to alter values he must use the (C)hange data option.

DATA SUMMARY

FY	***** QUANTITIES ***** SOLE	1ST C	2ND C	* NON-RECURRING COST * SOLE	1ST C	2ND C
85	2,300	2,300	0	3.0	3.0	91.0
86	3,000	3,000	0	2.0	2.0	2.0
87	4,000	4,000	0	1.0	1.0	2.0
88	4,000	3,996	4	0.0	0.0	2.0
89	4,100	2,500	1,600	0.0	0.0	2.0
90	6,000	3,600	2,400	0.0	0.0	2.0
91	6,000	3,600	2,400	0.0	0.0	2.0
TOTAL	29,400	22,996	6,404	6.0	6.0	103.0

FIRST UNIT COST	0.779	0.779	0.779
PROGRESS CURVE	91.00	91.00	89.00
PRODUCTION RATE	100.00	100.00	100.00
SHIFT %		0.00	0.00
ROTATION %		3.00	3.00

DISCOUNT RATE (%)= 0
ASSIGN COMPETITIVE SPLIT
TO MINIMIZE COST? NO
YEAR OF SHIFT/ROT= 89

FIGURE IV-9

Feasibility Analysis

This option calculates the cost savings (price reduction) likely to result from competition. Feasibility analysis requires data on overhead rates (OH), direct labor rates (DL), material costs (ML) and indirect labor (IL) costs as percentages of total costs. A multiplicative constant is also required, this constant is a production line cost coefficient which will account for any changes in production line costs. Feasibility analysis is used to calculate the likely price reduction for the project under examination and therefore, the data inputs can be tailored either to a particular industry or individual firms and the basic data can be adjusted to the pecularities of a particular case. See Chapter VII of Volume I for a detailed explanation of how to use the feasibiltiy analysis. Appendix C of Volume I contains yearly data for the 22 SIC codes most relevant to defense procurement. Table IV-1 below contains averages for the last 10 years for these industries for the four parameters (OH, DL, ML, and IL) required. Table IV-1 also presents price reductions for various values of the multiplicative constant. These values can be used directly for preliminary analyses.

					Price Reduction				
Sic No.	Description	Direct Labor Averages	Material Costs Averages	Overhead Costs Averages	Indirect Labor Averages	0.0	.05	.10	.15	.20
3313	Electrometallurgical Products	10.43	60.13	21.05	3.62	5.40	9.33	13.25	17.18	21.11
3441	Fabricated Structural Metal	14.92	56.05	20.22	8.05	5.30	8.69	12.48	16.07	19.65
3511	Turbines/Turb. Generator Sets	12.53	44.49	42.98	12.01	16.71	19.56	22.42	25.27	28.12
3542	Machine Tools, Metal-Forming	19.11	41.50	39.40	11.07	10.99	14.02	17.05	20.08	23.11
3544	Special Tools, Dies, Jigs, Etc.	31.95	29.09	38.96	11.30	7.45	10.50	13.55	16.60	19.65
3561	Pumps and Pumping Equipment	12.55	46.61	40.84	11.86	14.55	17.51	20.47	23.43	26.38
3563	Air and Gas Compressors	11.89	40.94	39.17	11.30	13.78	16.74	19.70	22.62	25.66
3566	Speed Changers, Drives, Gears	18.69	36.51	44.79	11.43	17.67	20.43	23.19	25.95	28.71
3573	Electronic Computing Equipment	7.30	45.99	46.71	15.66	17.26	19.93	22.60	25.26	27.92
3592	Carburetors, Pistons, Rings, Valves	25.78	36.11	38.12	8.78	11.91	15.01	18.10	21.20	24.29
3613	Switchgear, Switchboard Apparatus	15.25	39.60	45.15	9.96	21.15	23.89	26.63	29.38	32.12
3621	Motors and Generators	17.79	43.75	38.46	8.68	14.81	17.89	20.96	24.04	27.12
3622	Industrial Controls	14.90	37.43	47.66	14.16	18.13	20.75	23.37	25.99	28.60
3662	Radio, TV Communication Equipment	13.86	35.02	50.30	20.97	11.87	14.35	16.83	19.32	21.80
3674	Semiconductors, Related Devices	12.01	35.74	52.25	18.61	17.02	20.20	23.59	26.98	27.37
3694	Engine Electrical Equipment	18.39	45.96	36.12	7.13	14.19	17.40	20.62	23.84	27.05
3721	Aircraft	12.26	49.95	37.79	14.37	7.77	10.88	14.00	17.10	20.21
3724	Aircraft Engines and Engine Parts	14.67	45.55	39.68	13.97	9.69	12.70	15.72	18.73	21.74
3728	Aircraft Equipment, N.E.C.	18.88	39.18	42.11	16.67	7.63	10.52	13.41	16.31	19.20
3761	Guided Missiles, Space Vehicles	18.46	33.69	55.85	24.47	14.94	16.25	18.46	20.66	22.87
3764	Space Propulsion Units, Parts	12.18	22.38	54.58	24.24	13.67	15.40	17.12	18.85	20.58
3769	Space Vehicle Equipment, N.E.C.	15.29	31.79	52.92	23.24	11.99	13.44	17.30	18.15	20.51
	average	15.58	41.59	42.43	13.73	12.65	15.71	18.62	21.42	24.27
	max	31.95	60.13	55.85	24.47	21.15	23.89	26.63	29.38	32.12
	min	7.30	22.38	21.05	3.62	5.30	8.69	12.48	16.07	19.65

TABLE IV-1

Figure IV-10 illustrates what the screen looks like when a feasibility analysis is in progress and lists the formula used to calculate the likely price reduction. As noted on the screen, the overhead rate, direct labor and material costs must add up to 100% and IL must not exceed DL as IL is only one component of DL (the other components are 40% of direct labor and 10% of material costs).

```
The formula for price reduction is:

PR = OH -.4*DL - .1*MC - 1.4*IL + C*(DL + MC)

where PR = Price Reduction (%)        MC = Material Costs (%)
      OH = Overhead Rate (%)          IL = Indirect Labor (%)
      DL = Direct Labor (%)           C  = Constant - often set to .1

     NOTE: OH + DL + MC MUST EQUAL 100
           IL must not exceed DL

Overhead Rate (%)                          ? 50
Direct Labor (%)                           ? 25
Material Costs (%)                         ? 25
Indirect Labor (%)                         ? 10
Multiplicative Constant (often .1)         ? .1

Price Reduction (%) 28.5

Do you want to do feasibility again (Y/N)?
```

FIGURE IV-10

Feasibility analysis can only be accessed from the main menu and once you have completed your analysis you are returned to the main menu. Therefore, you must be sure to save the data file you have created before performing a feasibility analysis or your file will be lost.

HELP

When the help menu is "on" a more in depth description of menu options is available to the user. Once the user has become familiar with these options he will find that it is simpler (and faster) to turn help "off" through use of the (H)elp - turn OFF option.

Help is "on" for this menu

```
(A)nalysis - Calculate all costs over the program life
(B)reakeven - Find second source parameter values that lead to same costs
   with or without competition
(C)hange data - Any input factors may be altered
(D)isplay input data on screen only
(P)rint input data and analysis on printer and screen
(S)ave data on disk
(H)elp - turn OFF
(M)enu change to higher level - be sure to save new data first
ENTER THE APPROPRIATE LETTER? h
```

Help is "off" for this menu

```
(A)nalysis, (B)reakeven, (C)hange data, (D)isplay data, (P)rint
(S)ave data, (H)elp - turn ON, (M)enu up - be sure to save new data first
ENTER THE APPROPRIATE LETTER?
```

Print

When satisfied with any case, the user can print out the results by using the (P)rint option. After selecting P and return, CAM requests a title. A title as wide as the screen can be accommodated. This allows the user the opportunity of naming the report for future reference, for example "AIM-7F - first data analysis using leader follower". After the title is entered, the Data Summary table is

printed followed by the Competition Analysis table. See Figure IV-11a and Figure IV-11b below.

DATA SUMMARY

FY	***** QUANTITIES ***** SOLE	1ST C	2ND C	* NON-RECURRING COST * SOLE	1ST C	2ND C
85	2,300	2,300	0	3.0	3.0	91.0
86	3,000	3,000	0	2.0	2.0	2.0
87	4,000	4,000	0	1.0	1.0	2.0
88	4,000	3,996	4	0.0	0.0	2.0
89	4,100	2,500	1,600	0.0	0.0	2.0
90	6,000	3,600	2,400	0.0	0.0	2.0
91	6,000	3,600	2,400	0.0	0.0	2.0
TOTAL	29,400	22,996	6,404	6.0	6.0	103.0
FIRST UNIT COST	0.779	0.779	0.779	DISCOUNT RATE (%)= 0		
PROGRESS CURVE	91.00	91.00	89.00	ASSIGN COMPETITIVE SPLIT		
PRODUCTION RATE	100.00	100.00	100.00	TO MINIMIZE COST? NO		
SHIFT %		0.00	0.00	YEAR OF SHIFT/ROT= 89		
ROTATION %		3.00	3.00			

FIGURE IV-11a

COMPETITION ANALYSIS

FY	*** SOLE SOURCE *** QTY	RECUR COST	N.REC COST	******* COMPETITIVE ******* QUANTITIES * 1ST	2ND	RECUR COST	N.REC COST	DISCOUNT COMPET SAVING	DISCOUNT COMPET SAVING
85	2,300	723.0	3.0	2,300	0	723.0	94.0	-91.0	-91.0
86	3,000	764.6	2.0	3,000	0	764.6	4.0	-2.0	-2.0
87	4,000	930.7	1.0	4,000	0	930.7	3.0	-2.0	-2.0
88	4,000	876.0	0.0	3,996	4	877.8	2.0	-3.9	-3.9
89	4,100	860.9	0.0	2,500	1,600	875.6	2.0	-16.7	-16.7
90	6,000	1,212.1	0.0	3,600	2,400	1,105.0	2.0	105.2	105.2
91	6,000	1,170.1	0.0	3,600	2,400	1,033.0	2.0	135.1	135.1
TOT	29,400	6,537.4	6.0	22,996	6,404	6,309.7	109.0	124.7	124.7

Competitive Saving as % of Sole Source (Discounted) = 1.9

FIGURE IV-11b

Save

The user can also save this data onto disk. When the (S)ave option is chosen, by pressing first S and then return, CAM asks for a file name of no more than 8 characters. CAM adds ".CAM" to whatever name the user supplies; the user should not do this. The save option is independent of the print option. This feature allows the user to print, save to disk or do both. However, it also means that there is no cross tracking by CAM between the file name and the title of printed table. The user has to keep track that the file labeled "Sample" (for example) is the first data analysis of the AIM-7F using leader follower.

CHAPTER V

DOING ANALYSIS WITH CAM

CAM is a very powerful tool for doing cost analysis of competition. It's main features are specially designed to facilitate doing such analysis and the basic logic of its data input should become easily familiar to cost analysts. Users will quickly see what it can do and discover the most feasible way of accomplishing their desired analysis. These remarks about doing analyses are designed merely to facilitate use by the new user and in no way do they show the full potential of CAM.

Sensitivity Analysis. CAM facilitates doing sensitivity (i.e. what if) analysis by its use of change data/analysis options. Users can first see the cost impact of any given set of input values and then quickly see the impact of changing these basic values on the screen without needing to print out cases of no interest. Once a case of interest has been found CAM easily allows the results to be either printed out or saved to file for future reference. For example each time some major parameter is changed, the results can be printed out or saved or both.

Feasibility of Savings. CAM's computation of the percentage savings is a major aid to analysis (Figure IV-1, the Competition Analysis table). Without this figure, there is a intellectual gap between specifying percentages for shift and rotation and the actual percentage savings or losses that will be incurred over the life of the project. The percentage saved figure is important in its own right as many analysts and decision makers believe they have more insight into the percentage savings available that will be realized from competition than in detailed estimates of shift and rotation. Also the percentage figure allows for the direct comparison of the estimated savings computed

by the Feasibility Analysis option.

Breakeven Analysis. CAM's built in capability to do breakeven analysis is an invaluable assistance to the cost analyst. This capability requires however that only one variable, either quantity, shift, or rotation, be unspecified. If a user does not wish to specify neither shift nor rotation, but only wishes to compute the savings required, he can do so in the following fashion. He would select the **(N)**ew data file option and enter the appropriate sole source data. When CAM moved to shift and rotation input the user would specify zero shift and rotation for either the second competition or both. He would then select the **(A)**nalysis option. The percentage loss computed by CAM represents the percentage price reduction that competition would have to create for competition to breakeven. It is this number that could be subjected to further analysis, including comparison with the economic data presented in **Appendix C of Volume I.**

This formulation of the problem requires the cost analyst to specify the first unit price for both competitors under competition. Normally, if the user does not have the first unit price information for both of the producers under competition he will use the sole source first unit price as a substitute. However, during the course of the analysis this first unit sole source price substitute is likely to change. Use of the sole source unit price is simply an analytical technique that enables us to perform breakeven analysis when we do not have the first unit price for both firms under competition.

GLOSSARY

Breakeven Analysis - This analysis calculates the point at which the gains or losses from completition are exactly zero. CAM has several breakeven calculations which can be performed.

Competition Analysis - An analysis performed by CAM which computes, by year, the cost of sole source production as compared to competitive production. The difference is the savings, if any, from competition. This analysis is based on user supplied inputs.

Cost Minimization through Quantity Allocation - This option allows the user to have CAM automatically allocate the larger quantity, in a split buy, to the less costly producer. Use of this option does not change the user supplied production split (e.g. 60-40) only how it is allocated between the two procedures.

Discount Rate - The interest rate used to compute net present value. OMB Circular A 76 has set this rate at ten percent for Government analysis. Also referred to as the hurdle rate, interest rate or opportunity cost of capital.

Feasibility Analysis - In CAM, Feasibility Analysis refers to computing the maximum savings from competition likely to be achieved. This figure is used in conjunction with CAM's Competition Analysis to determine whether the savings projected by the competition analysis are within the range of possible savings. CAM's feasibility analyses are based on published data summarized in this computer manual.

First Unit Cost – The (theoretical) cost of the first unit produced. Frequently, this number is computed from the learning curve and lot cost data.

Learning Curve – See Progress curve

Non-Recurring Costs – Non-recurring costs are also called start-up costs and are incurred only once. They are similar to fixed costs and are usually incurred for expenditures on capital equipment, specialized test equipment and technology exchange. They are not normally independent of the anticipated quantity to be produced.

Number of Years – This input variable should account for the number of years the program is expected to last. All production years must be included and the period can be extended, if necessary to include non-recurring costs incurred prior to production.

Production Rate – A user supplied parameter to allow for production rate effects on unit cost. This parameter is used to account for any cost penalty associated with splitting annual production runs.

Production Split – A input parameter which tells CAM how the total annual production will be allocated between the two producers.

Progress Curve – A curve used to predict the unit cost based on slope and quantity produced. Key parameter is the slope measured in percentage term (e.g., 90%). Also called the learning curve, the improvement curve and the experience curve.

Recurring Costs – These costs occur every time an additional unit of output is produced.

Rotation – Is the steepening of a progress curve caused by competition. If a learning curve begins at 90% and then moves to 85% it is said to have rotated 5%.

Shift – An upward or downward vertical movement in the learning curve caused by the occurrence of competitively driven price reductions.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

AD-A184017

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) ASC-R-162	5. MONITORING ORGANIZATION REPORT NUMBER(S) BRMC-85-5129-2
6a. NAME OF PERFORMING ORGANIZATION Administrative Sciences Corp. 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Air Force Business Research Management Center
6c. ADDRESS (City, State and ZIP Code) 5305 Lee Highway Arlington, VA 22207	7b. ADDRESS (City, State and ZIP Code) Wright-Patterson AFB, OH 45433
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable) RDCB	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER F33615-85-C-5129
8c. ADDRESS (City, State and ZIP Code)	10. SOURCE OF FUNDING NOS. PROGRAM ELEMENT NO.: 71113F PROJECT NO.: Ø TASK NO.: Ø4 WORK UNIT NO.: Ø
11. TITLE (Include Security Classification) Competition Analysis Model - Computer Manual (U)	
12. PERSONAL AUTHOR(S)	
13a. TYPE OF REPORT Manual 13b. TIME COVERED FROM Sep85 TO Jun 87 14. DATE OF REPORT (Yr., Mo., Day) 1987, June 12 15. PAGE COUNT 35	
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES		
FIELD	GROUP	SUB GR.
5	1	9
5	3	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Acquisition, Competitive Strategies, Contracting, Computer Models.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The Competition Analysis Model, CAM, is designed to provide computational and analytical support to decisions on competition strategy and provide support throughout the life of a project. It is useful for decisions both early in the acquisition cycle and as a foundation for later detailed analyses at both the prime system level or for subsystems and components. CAM does not extrapolate from past experience, but outlines an approach to structuring competition based upon goals and relevant data. The Competition Analysis Model consists of three volumes (CAM Analysis Guide, CAM Computer Manual, and Program Maintenance Manual) and a disk containing the BASIC code for IBM-PC or PC compatible computers. This volume, CAM Computer Manual, is directed at the user who wishes to run the software and understand how the software can be used to do cost analysis of competition.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Major Richard Collins	22b. TELEPHONE NUMBER (Include Area Code) (513) 255-6221 22c. OFFICE SYMBOL RDCB

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

END

10-87

DTIC